INSTRUCTION MANUAL

LevelGenie

ULTRASONIC
LEVEL SWITCH

MILLTRONICS

730 The Kingsway, Peterborough, Ont. Can. K9J 6W6
Telex 06-962851 Tel. 705-745-2431

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PROCESS CONTROLS FOR INDUSTRY

PL 141

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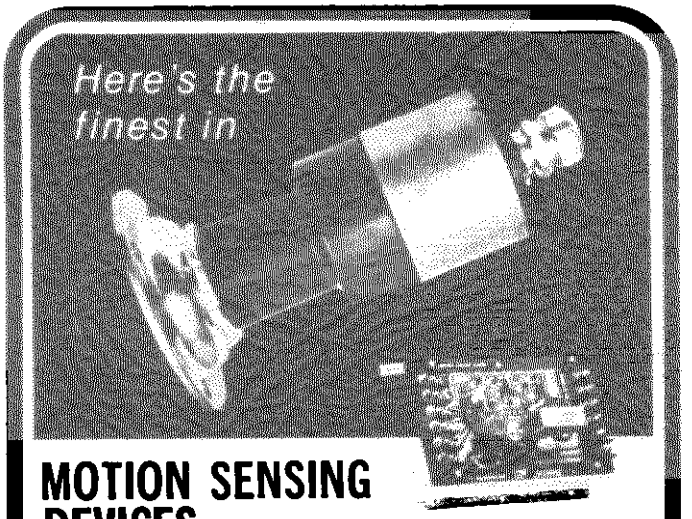

MOTION SENSING DEVICES featuring Milltronics advanced probe design

Our environment-proof, cast epoxy, electro-magnetic probe eliminates need for mounting magnets on monitored equipment. The integrally mounted probe pre-amplifier enables you to install for two wire motion sensing at distances over 5,000 feet.

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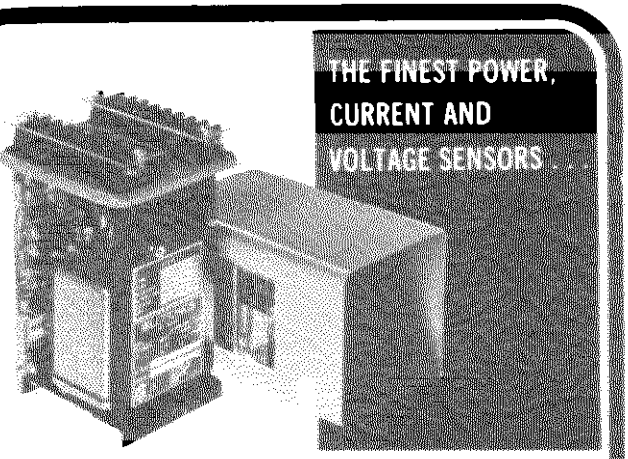

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We now offer a complete line of transducers for power, current & voltage measurement and/or control purposes. The units offer individual zero, span and response time adjustments with true current output signals in a standard general purpose housing. Watt measurement to ± 0.5% with unity to lead or lag 0 is made easy. Our voltage and current transducers provide 0.2% linearity. Now, more than ever before, you should look to Milltronics for your process instrumentation.

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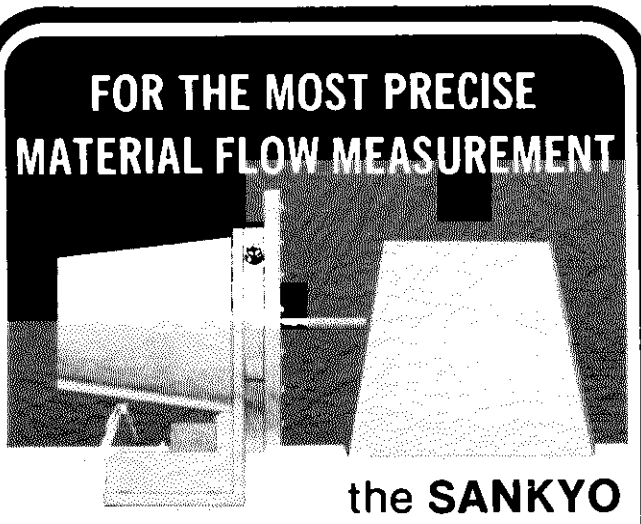

the SANKYO IMPACT LINE FLOWMETER

A totally enclosed weighing system with no zero drift operation, that is economical to operate and easy to install. The Sankyo Flowmeter accurately records flow of materials ranging in size from microns to footballs. Solids, slurries or liquids can be measured with perfect accuracy.

CSA approved for hazardous applications.

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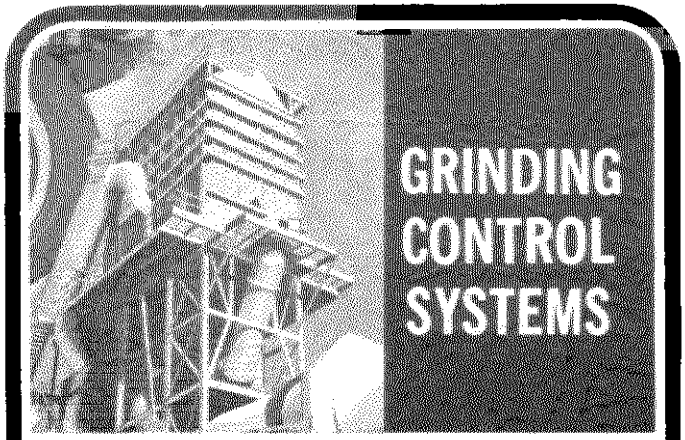

Milltronics offer you the only patented grinding control system available. The reliability of this system is proven every day by hundreds of working installations around the world. Its unique flexibility makes it easily adaptable to your grinding circuit. The Milltronics grinding system not only improves the uniformity of grind but actually increases production rates from 5% to 15% and reduces production costs. This is one of the soundest investments you can make on your grinding mill operation. Why not contact Milltronics today and discuss your specific grinding system and how our world wide industry specialists can help.

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I. GENERAL INFORMATION

The Milltronics Level Genie Ultrasonic System is an entirely "Solid State Package", designed to provide contact closure at accurately determined levels of liquids and solids up to 10 feet (3M) from the transducer. This system consists of only two elements, ultrasonic transducer and cabineted electronics, neither of which require contact with the material to be measured. Seperation between transducer and electronics may reach 600 feet (183M).

The Level Genie measures the time required for a transmitted ultrasonic pulse to complete a round trip from the transducer to the sensed material and back. This measurement is converted electronically into distance and then compared with the two independently adjustable set points. Depending on the programming module employed, this comparison actuates the output relays whose 10 amp 115 VAC contacts indicate material level status.

Programming modules, available in easily changeable plug-in form, allow the Level Genie to operate as; an independent high and low alarm, as two high alarms, as two low alarms or as a pump control.

In addition to the normal set point hysterisis, selectable time delays of 3 or 10 seconds may be introduced via a convenient P.C.B. mounted switch.

The unique digital noise rejection circuitry of the Level Genie allows placement of the electronics in motor control centers and direct interlocking of primary devices via the contact outputs.

II. SPECIFICATIONS

Power Required	115 VAC ± 10% 40 Hz at 6VA
Transducer	Barium Titanate element C.P.V.C. outer housing and polyurethane radiating face. Optional face materials are available. Transducer rated for Class I, Groups A, B, C, D, &'Class II Groups F & G.
Range	1.5 to 10.0 feet 0.45 to 3.1 meters
output	Two (2) Form C, S.P.D.T. contacts rated 10A 115VAC non-inductive
Set Points	Two (2) independently adjustable throughout the range
Set Point Hysterisis	0.5 inch per ft. of range when in alarm mode
Response Time	0.5 sec. without time delay
Time Delay	Selectable 3 or 10 seconds
Repeatability	Better than 0.1% (l/16"' on 5' range or l/8" on 10' range)
Temperature Effects	Setpoint varies -0.17% of range/°C deviation from calibration temperature
Temperature Range	Electronics -2OO°C to +60°C '-5 to +140°F) Transducer -40°C to +93°C (-40 to +200°F)
Separation	Maximum distance from transducer to electronics is 183M (600 ft.) using RG-62U co-axil cable

Operating Modes*	1. Pump up/down 2. Hi-Lo alarm 3. Hi-Hi alarm 4. Lo-Lo alarm * One programming module supplied with unit. Additional modules available as options.
Enclosure	Nema 12 standard Nema 4 optional
Weight	Transducer - 2 lbs. Enclosure & Electronics - 12 lbs.

III. THEORY OF OPERATION

TRANSCEIVER CIRCUITRY

1. General Description

The transceiver uses a single tuning section which is time-shared between the transmitting and receiving functions. Three co-ordinatinq signals, generated in conjunction with the repetition rate signal, control the transceiver switching it between transmitting and receiving modes.

2. As a Receiver

Echo signals, generated when an echo strikes the face of the transducer, are presented to the receiver input via R1. Diodes D1 and D2 protect the receiver input from the out-going transmit pulse by limiting signals at the receiver input to plus or minus one diode drop.

Q1 amplifies the echo signal and presents it to the base of 03 via C3. (Q2 is associated with the transmit function and will be discussed later) Q3 provides two receiver functions. Firstly, it is a tuned amplifier operating in conjunction with the tank circuit formed by the inductance of the primary winding of Tl and C5. Secondly, Q3 provides time varying gain to over-come transducer ringing which occurs immediately after trans-mittinq.

Just after transmitting, when ringing is most severe, Q3 is driven by very strong signals. These signals cause a buildup of voltage at the emitter of Q3. R9 and C6 have been chosen so that the excess voltage at the emitter of Q3 decays away at a rate which matches the decay of ringing within the transducer. During the first 1.5 milliseconds after the transmit pulse is sent, the receiver is rendered in-operative by a blanking signal. By the time the blanking signal is removed the decay process is well under way. Q3 operates as an amplifier whose gain increases with time in a way that ensures it is always insensitive to transducer ringing but still sensitive enough to respond to any strong echo which may be returned from a nearby target.

Q6 and Q7 provide additional amplification. Q7 also serves as a detector charging C9 with the positive half-cycles of the received signal.

Q8 is turned on during the blanking period to prevent C9 from accumulating any charge. Thereby precluding any receiver output during this time period,

When the voltage on C9 reaches about 1 volt, Q9 turns on and the voltage at the collector of Q9 falls to zero signifying reception of an echo.

The network formed by D3, R25, and Cl1 provides a delayed receiver output which responds only to signals of a half millisecond duration or longer. Noise spikes of short duration are therefore ignored.

3. As a Transmitter

Q2 and Q5 control the change over from receiver to transmitter. During transmit time, Q2 is turned on dissabling Q3 and Q5 is turned off releasing Q4 to operate in place of Q3.

Q4 and Q6 are in a closed, positive feedback loop which oscillates at the frequency to which the primary of Tl and C5 are tuned ie. at the receiver's operating frequency.

Two gates of IC-7 form a monostable multivilrator. During transmit time, pin 9 of IC-7 is held low allowing the monostable to product a string of pulses each a little less than a half cycle of transmit frequency but spaced exactly a half cycle apart. QlO, Qll, and Q12 amplify these pulses in class C fashion and apply them to the primary of transformer T2. T2 increases the signal to about 350V peak-to-peak to drive the transducer.

ECHO PROCESSING LOGIC

1. General Description

The digital echo processor establishes the necessary timing and limit functions. Coincidently, statistical techniques are employed to discriminate against response to spurious noise inputs.

2. Timing & Limit Generation

IC 3-1, IC 3-2 and IC l-l form a typical hybrid monstable multivibrator. This type of pulse generator is extremely stable over a wide range of temperature and/or bus variations.

Repetition rate generator ICl-3 triggers the timing monostables which generate the following functions; pulse width, blanking, the'NEAR' setpoint, the'FAR'setpoint, and limit. (Maximum Range)

Switch SWl, the maximum range switch, allows the range to extend to either 5 feet or 10 feet.

3. Alarm Point Recognition

IC 5-1, IC 5-2, IC 6-l and IC 6-2, are C-MOS NOR gates. Each gate accepts two inputs, the processed echo and one of the timing functions. The order in which the timing functions are connected to the gate inputs determines the mode of operation of the unit, ie. Hi-Lo alarm, Lo-Lo alarm. Plug-in programming modules allow easy field modification.

Another toggle on switch SW1 allows introduction of either a 3 second or 10 second delay on alarm. Moving the third toggle (SW1) from run to calibrate removes these delays.

Resistors R62 and R65 about IC 2-3 and IC 2-4 provide alarm point hysterisis of 0.5 in. (12.5mm) per foot of range.

4. Digital Echo Processing

Various digital, statistically based, processing techniques are employed to render the Level Genie immune to random noise inputs.

a. Echo width detection ignores short duration signals such as line transients and most SCR noise.

b. Echo reception logic accepts only one echo per transmit sequence.

c. Digital windows are established at the"NEAR'and 'FAR'setpoints and only echoes occurring in these zones are recognized.

d. It requires three valid echoes in three successive transmit sequences in order to trigger an output response.

IV. INSTALLATION

1. Electronic Package

The electronic circuits of the Level Genie Ultrasonic Level Switch are contained on a single printed circuit motherboard. A Nema 12 enclosure is supplied. Refer to Fig. 1 for outline and mounting dimensions.

Separate 1/2" conduits should be installed for the power wiring and the transducer cable. The transducer cable must not be installed in a conduit with other wiring. Fig. 3 indicates proper terminal connections for the electronics. Note, that the power input must include a good electrical ground.

Since the Level Genie is designed for continuous operation, a power switch has not been provided. If one is desired it may be included in the external power circuit.

2. Pre Start-Up Checks

(A) Unit Synchronization

To avoid cross talk between multiple units located in the same panel or with common transducer runs, the units must be synchronized. (They must transmit simultaneously).

To synchronize any number of units, series connect terminal 10,marked "SYNC", with jumpers from unit to unit.

(B) Program Module

Be sure the program module is installed in the correct orientation. (With the rounded corner toward the top of the circuit board).

(C) Switch SW1

The "RUN - CAL" toggle should be in the "CAL" position to

5. Alarm Anti-Latch Circuit (stab select at A position)

In some applications, the Level Genie is used to detect an object instead of a material level. Usually, a HIGH-HIGH program module can be used: HIGH alarm to detect the object and in the absence of the object, echoes received from any target out of HIGH alarm zone will reset the system. However, if there is no target to intersect the ultrasonic beam within 10 feet (the maximum range of the Level Genie), no echo will be received. In this case, the alarm anti-latch circuit will unlatch both alarm circuits in less than one second and get the system ready for the next detection.

This situation may also happen when there is an alarm in a dusty area and suddenly the material level is moved out of the alarm region so fast that it causes the loss of echo. The alarm anti-latch circuit will again unlatch the alarm (ie. reset the system), when the loss of echo is more than one second. (Note:. the minimum delay on the alarms is about 3 seconds).

The system reverts to normal operation under one of three following conditions:

a. Whenever a regular echo is being received.
b. Whenever the pump program module is installed.
c. When stab select is changed from A to B position which is the standard position (without anti-latch circuit).

disable the alarm time delays while calibrating.

The "10 ft. - 5 ft.'" toggle should be in the appropriate position reflecting the desired operating range.

3. Transducer

The ST25 series transducers have an outer housing of chlorinated polyvinyl chloride (CPVC) and a radiating face of polyurethane. These materials have excellent resistance to a wide range of corrosives but may be damaged by ketones, aromatics and some chlorinated hydrocarbons. Alternate materials are available for these environments.

The operating range of the transducer is between -4O°C to +93°C (-400°F to +200°F). These temperatures must not be exceeded at the face of the transducer or permanent damage may result.

The ST-25 transducer is generally mounted at the top of the vessel with its'radiating surface aimed directly down at the surface of the material being measured. The transducer is provided with a 1" NPT nipple for direct attachment. See Fig. 2 for transducer dimensions and typical mounting.

a. Mount the transducer at least eighteen (18) inches above the highest level the material will reach in the vessel directly beneath the transducer. This minimum distance between material and transducer must be provided for proper operation of the system at high material level.

b. Locate the transducer as far as possible from the point the material enters the vessel to minimize interference from sonic noise generated by the incoming material and to prevent the material from falling or splattering into the sound path between the transducer and the material being measured.

c. Do not locate the transducer directly above any object

within the vessel such as a supporting beam which would interfere with the sound path between the transducer and the material being measured.

NOTE

Ultrasonic sound waves are radiated from the face of the Transducer within a cone of approximately 8 degrees. The Level Genie System depends upon these sound waves reaching the surface of the material to be measured and being reflected back along this same "sound path". Any object within this "sound path" that reflects an "echo" will interfere with the measurement of the material level.

For practical purposes the transducer should be located one half bin radius from the side wall (assuming a center fill bin.1

d. Position the transducer so that its radiating surface is aimed directly at the material to be measured. When measuring liquids, the radiated beam or sound path must be perpendicular to the liquid surface.

V. CALIBRATION

Before applying line power to the Level Genie, ensure that all pre-start-up checks (Section IV) have been completed.

1. General Alarm Calibration

It is usually expedient to calibrate the Level Genie before installation, thereby avoiding the necessity of changing bin levels to set the trip points. After installation a spare transducer serves as an invaluable tool for checking calibration.

a. Set mode toggle (SWl) to "CAL"
b. Set the maximum range toggle (SWl) to the appropriate 5 feet or 10 feet maximum range.
c. Set the NEAR potentiometer fully counter clockwise.
d. Set the FAR potentiometer fully clockwise. This (Steps b & c) sets the trip points with "NEAR" at minimum range and "FAR" at maximum range, refer to FIG. 5.

SPECIFIC CALIBRATION OF HI-LO PROGRAM MODULE (OMIT IF OTHER PROGRAM USED)

e. With the transducer placed at a distance from a fixed target, representative of the low level, adjust the "FAR" potentiometer counter clockwise until RL2 just drops out. (LED2 will extinguish) The Low Level alarm is now calibrated.

f. With the transducer placed at a distance from a fixed target, representative of the desired high setpoint, adjust the "NEAR" potentiometer clockwise until RLl just drops out (LED1 will extinguish) The high alarm is now calibrated.

SPECIFIC CALIBRATION OF HI-HI PROGRAM MODULE

(OMIT IF OTHER PROGRAM USED)

g. With the transducer placed at a distance from a fixed target representative of the high level, farthest from the transducer, adjust the "FAR" potentiometer counter clockwise until LED2 comes on. Then turn the control slowly clockwise until LED 2 extinguishes (Relay 2 drops out).

h. Set the higher of the two high alarm points as follows. Adjust the target to sensor distance to correspond to the material level at the highest setpoint. Turn the "NEAR" setpoint control clockwise until LED 1 extinguishes (Relay 1 drops out)

SPECIFIC CALIBRATION OF LO-LO PROGRAM MODULE

(OMIT IF OTHER PROGRAM USED)

i. With the transducer placed at a distance from a fixed target representative of the low level, farthest from the transducer, adjust the "FAR" potentiometer counter clockwise until LED 2 extinguishes (Relay 2 drops out).

j. Set the higher of the two low alarm points as follows. Adjust the target to sensor distance to correspond to the material level at the highest setpoint. Turn the "NEAR" setpoint control clockwise until LED 1 illuminates, then turn the control slowly counter clockwise until LED 1 extinguishes (Relay 1 drops out).

COMMENTS APPLICABLE TO ALL ALARM PROGRAM MODULES

Delayed Response

Some applications may require time delay on "alarm". Switching the mode toggle of SW1 from "CAL" to "RUN" introduces

a delay in output response by 3 seconds or 10 seconds depending on the position of the delay toggle.

I M P O R T A N T

Rotating the"NEAR"and"FAR"setpoints in the direction of the arrows (on the PCB) brings the trip points closer together. Caution must be exercised not to cross these controls. The NEAR setpoint should always be set to a higher level than the FAR setpoint.

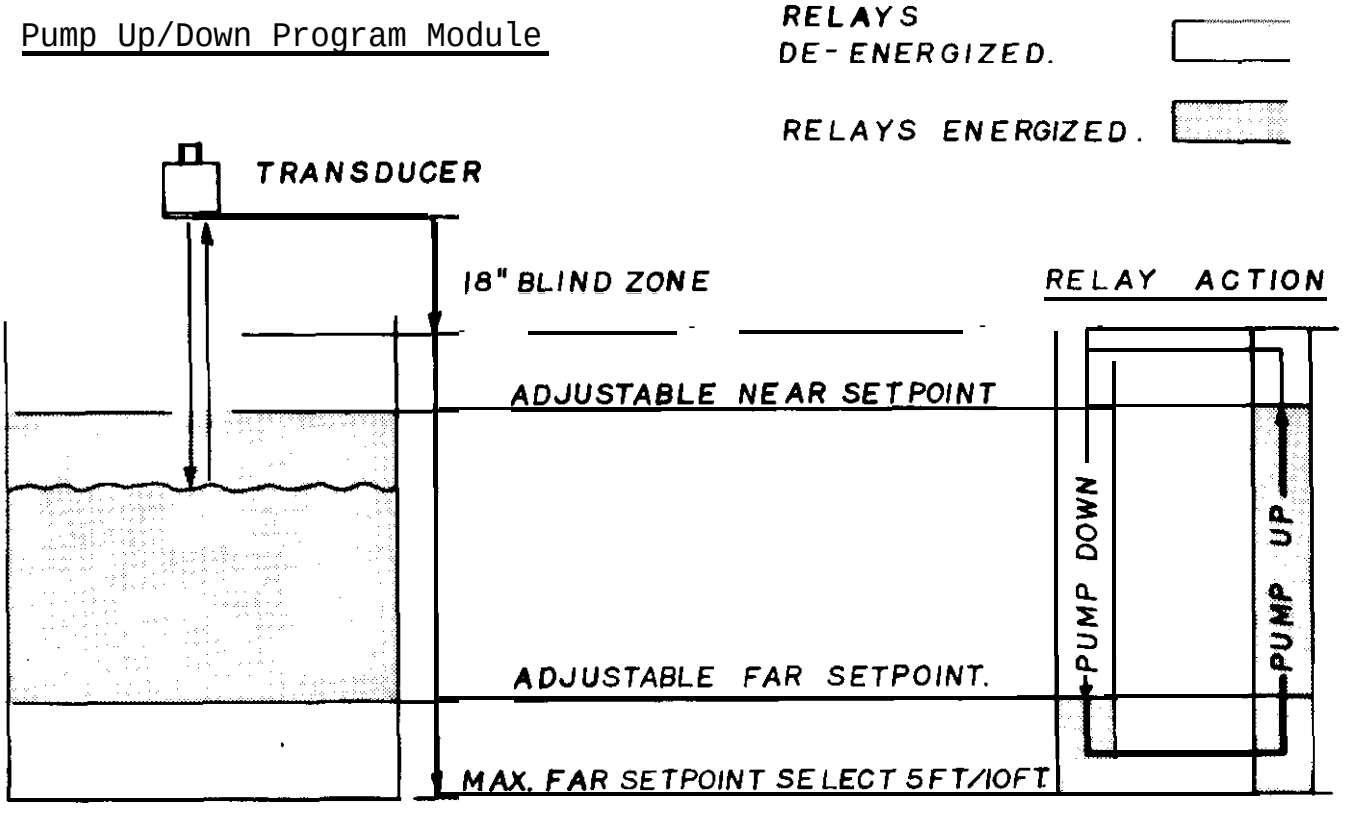
USING ONLY ONE OF THE DUAL ALARMS

As a precaution, to avoid having the NEAR and FAR settings crossed, use only the FAR setpoint for single alarm operation. Turn the NEAR setpoint fully counter clockwise.

HYSTERISIS

Approximately 0.5 in. (1.25cm) of hysterisis per foot of range is provided. Thus, a high alarm 8 feet from the transducer has a 4 inch deadband. That is, the material would have to drop to 8.33 feet before the alarm would clear.

2. Pump Up/Down Program Module



Actuation

In "pump down" operation, the liquid level must rise above the NEAR setpoint to de-energize the relays. Once this condition is met they are locked in the de-energized state, until the level drops below the FAR setpoint. Thus, rising above the near set-point sets the control state until a low or far level is achieved.

Similarly, for "pump up" operation, the level must drop below the far setpoint, which sets the relay state (energized) until the level exceeds the near setpoint.

Pump Module Calibration

It is usually expedient to calibrate the Level Genie before installation thereby avoiding the necessity of changing tank levels to set the trip points. After installation a spar transducer serves as an invaluable tool for calibration check.

a. Set mode toggle (SWl) to "CAL".
b. Set maximum range toggle (SW11 to the appropriate 5 feet or 10 feet maximum range.

c. Set the "NEAR" potentiometer 1/4 turn from fully counter clockwise.

a. Set the "FAR" potentiometer fully clockwise. This sets the trip point at maximum range.

e. Move the transducer toward the target until the LED indicators extinguish (relays dropped out). Then, with the distance between the transducer and target corresponding to the desired low level, adjust the "FAR" setpoint, slowly counter clockwise until the LED indicators illuminate (relays energized). The lower pump limit is now established.

f. Set the "NEAR" setpoint control fully counter clockwise. Move the transducer forward to a distance representative of the "high" level. Adjust the "NEAR" set point slowly clockwise until the LED indicators extinguish (relays drops out). The high pump limit is now established.

OTHER SETTINGS

Generally, pump modules are run with the mode switch in "CAL" position, as there is no advantage and possible disadvantage to using time delay in pumping applications.

I M P O R T A N T

The Level Genie is "blind" to levels (closer to the transducer than 18" and farther from the transducer than 30" below the low level control point.) When placing the Level Genie into service, it is imperative that the liquid level be within this limitation. This is an initial consideration only.

VI. MISCELLANEOUS

Checks to make before pushing the Panic Button

SYMPTOM	CAUSE
Unable to calibrate one setpoint	Program module offset in socket or inverted.
High Alarm apparently inoperative	'NEAR'setpoint set too close to minimum range or within blanking range. (Turn near setpoint in direction of arrow)
Erratic & Inability to calibrate	'NEAR'and'FAR-setpoint controls crossed (low set point placed above the high setpoint)
Alarm settings unstable when mode switch placed in "run" position	Time Delay excessive enabling the level to enter the blanked zone before alarming
Unable to calibrate Low alarm	Maximum range set to short (Switch SW1)

VII. MAINTENANCE

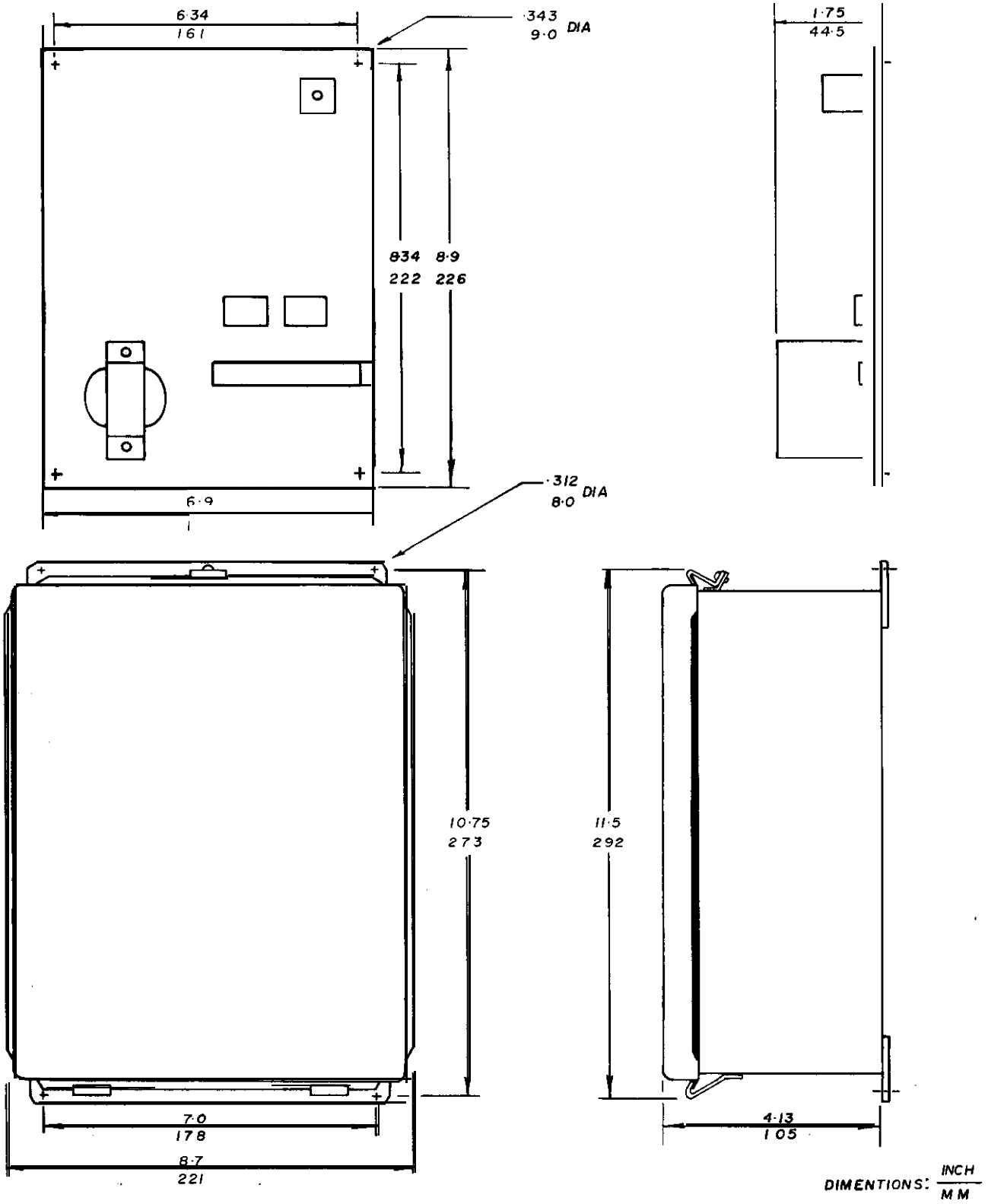
This equipment requires very little maintenance due to its solid-state circuitry. However, a program of periodic preventive maintenance should be initiated. This should include regular inspection, general cleaning, transducer face inspection, overall system performance checks, and standard good-housekeeping practices.

A periodic inspection of the transducer is recommended in some applications, at which time any build-up of material on the transducer face should be removed.

WARNING: TURN POWER OFF BEFORE ATTEMPTING TO CLEAN CHASSIS.

The chassis is best cleaned with a vacuum cleaner or a clean, dry cloth. Remove all layers of accumulated dust from printed-circuit board components. Check all electrical contacts for corrosion and wear.

BASIC UNIT WITH 2 ALARMS, (NEMA 12).



NOTES:

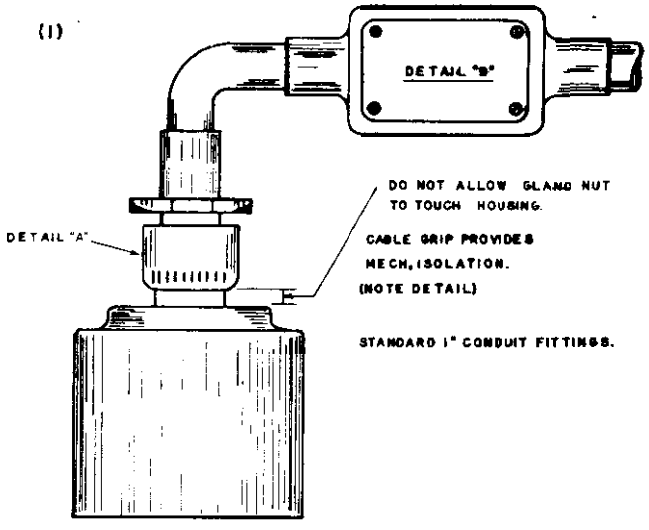
1. TO AVOID METAL FILINGS SHORTING CIRCUIT COMPONENTS, REMOVE THE ELECTRONIC ASSEMBLY FROM THE CABINET WHILE DRILLING CONDUIT ACCESS HOLES.
2. ENCLOSURE OPTION AVAIBLE - NEMA.4

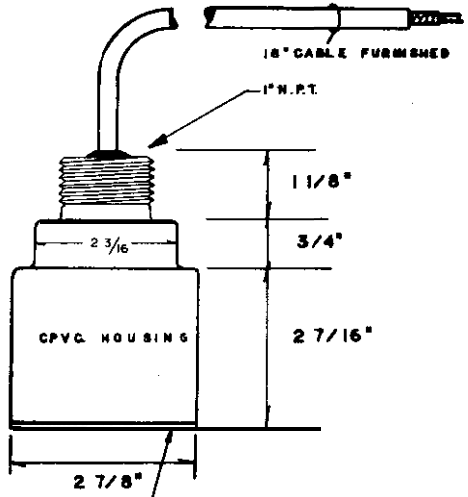
DWG - 10D332

FIG-1 OUTLINE & MOUNTING DIAGRAM

TRANSDUCER MOUNTING DETAIL

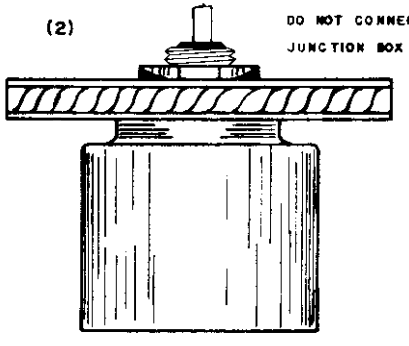
(1)


DETAIL "B"
DETAIL "A"
DO NOT ALLOW GLAND NUT TO TOUCH HOUSING.
CABLE GRIP PROVIDES MECH, ISOLATION. (NOTE DETAIL)
STANDARD 1" CONDUIT FITTINGS.



ST 258 — POLYURETHANE.
ST 258P — POLYETHYLENE FOAM.

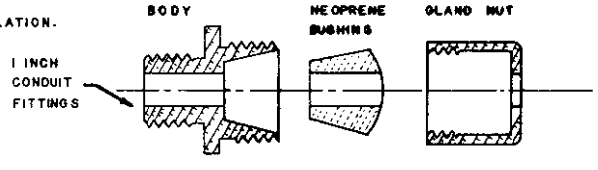
(2)



DO NOT CONNECT CONDUIT TO THE TRANSDUCER. JUNCTION BOX MUST BE MOUNTED WITHIN 15" OF TRANSDUCER.

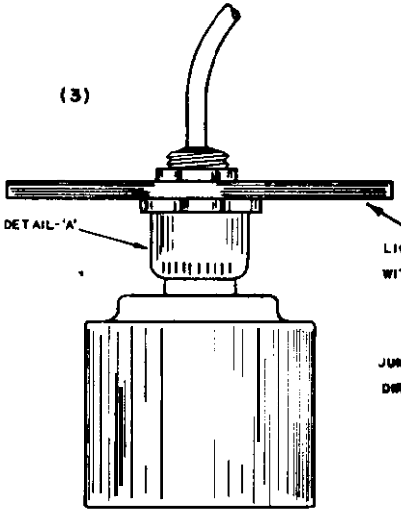
PLYWOOD MOUNTING PROVIDES MECH, ISOLATION.

DETAIL — 'A'



CROUSE HINDS - CGB39N OR EQUIVALENT.

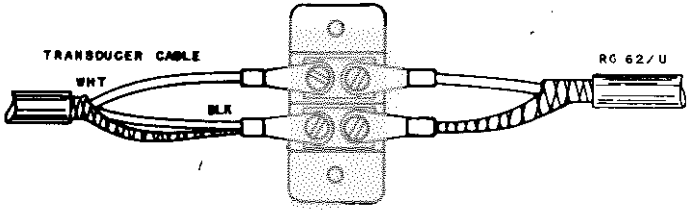
(3)



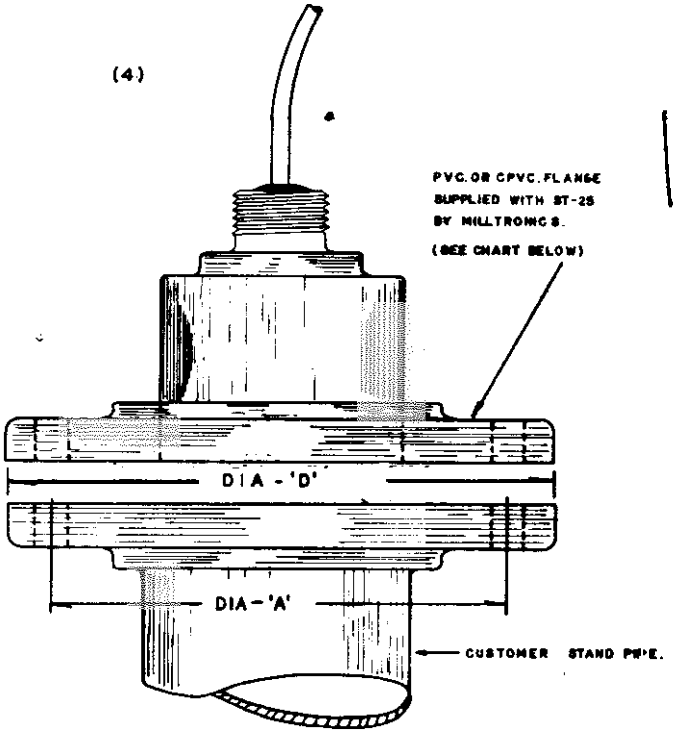
LIGHT WEIGHT FLANGE WITH HOLE FOR 1" FITTINGS.

JUNCTION BOX CAN BE MOUNTED DIRECTLY, OR WITHIN 15" USING FLEX. CONDUIT.

DETAIL — 'B'



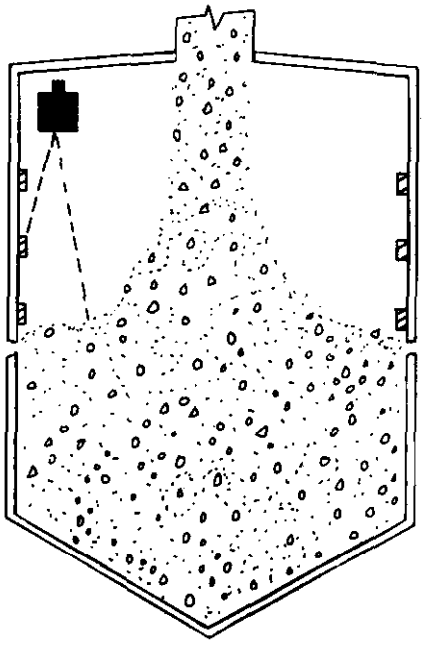
(4)



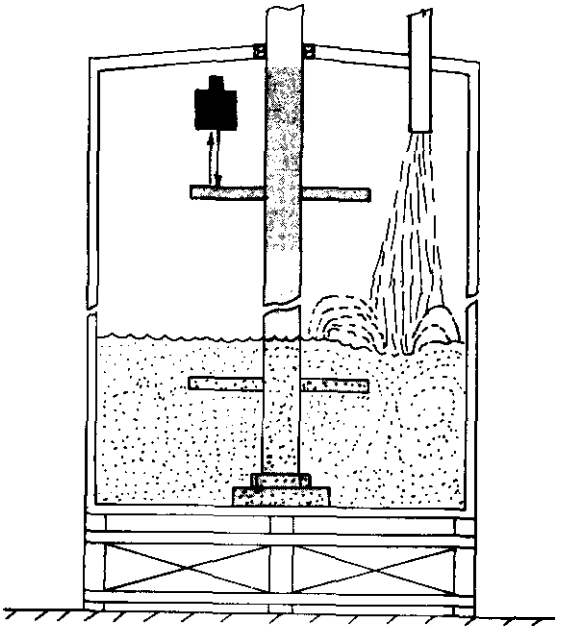
FLANGE SIZE	DIA 'A'	DIA 'D'
3"	6"	7 1/2"
6"	9 1/2"	11"
8	11 3/4"	13 1/2"

NOTE:-
TRANSDUCER CABLE SHOULD BE RUN IN A GROUNDED CONDUIT SYSTEM WITH NO OTHER ELECTRICAL CIRCUITS.

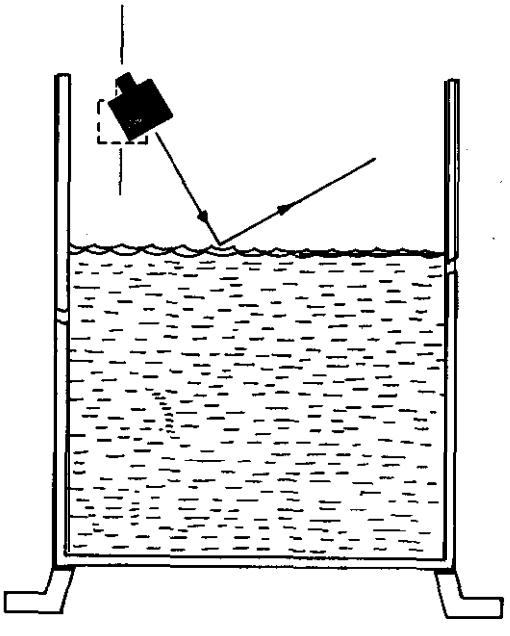
FIG 2- TRANSDUCER INSTALLATION.



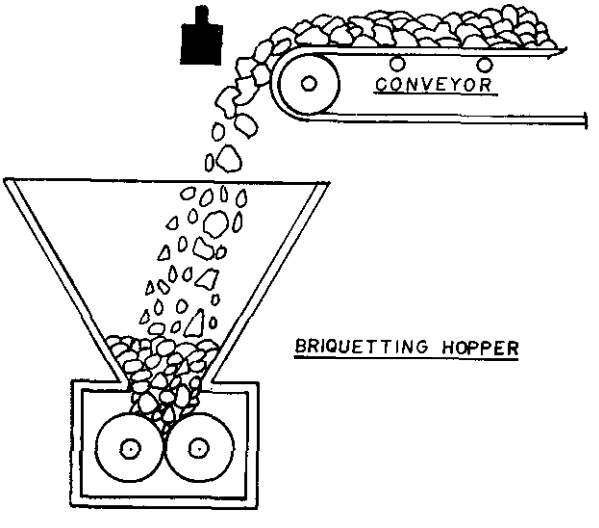
TRANSDUCER IS MOUNTED HARD TO THE VESSEL SIDE & PICKS UP REINFORCING BARS NOT MATERIAL MOVEMENT.



TRANSDUCER IS MOUNTED ABOVE AGITATOR OR OTHER OBSTRUCTIONS BLOCKING OUT LOWER BIN AREAS.

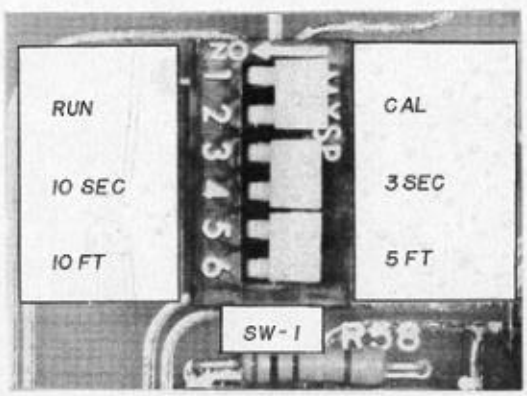


TRANSDUCER ANGLED SHARPLY TO THE LIQUID TARGET "BOUNCING AWAY" RATHER THAN RETURNING THE ECHO.

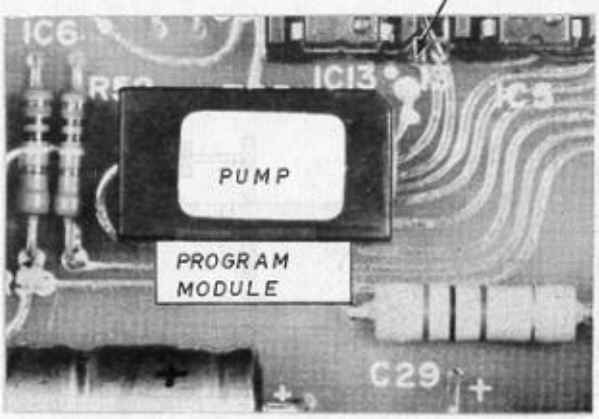


TRANSDUCER SEES ONLY FALLING MATERIAL DURING FILL.

FIG:3 EASILY AVOIDABLE INSTALLATION ERRORS.



NOTE POSITION OF PROGRAM MODULE WITH RESPECT TO THE DOT.



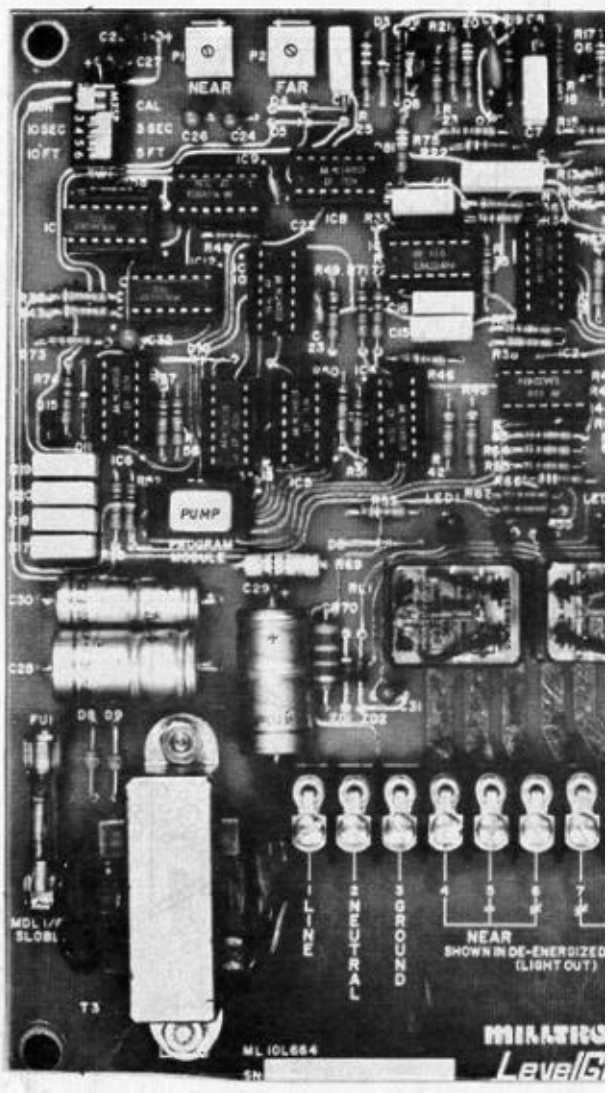
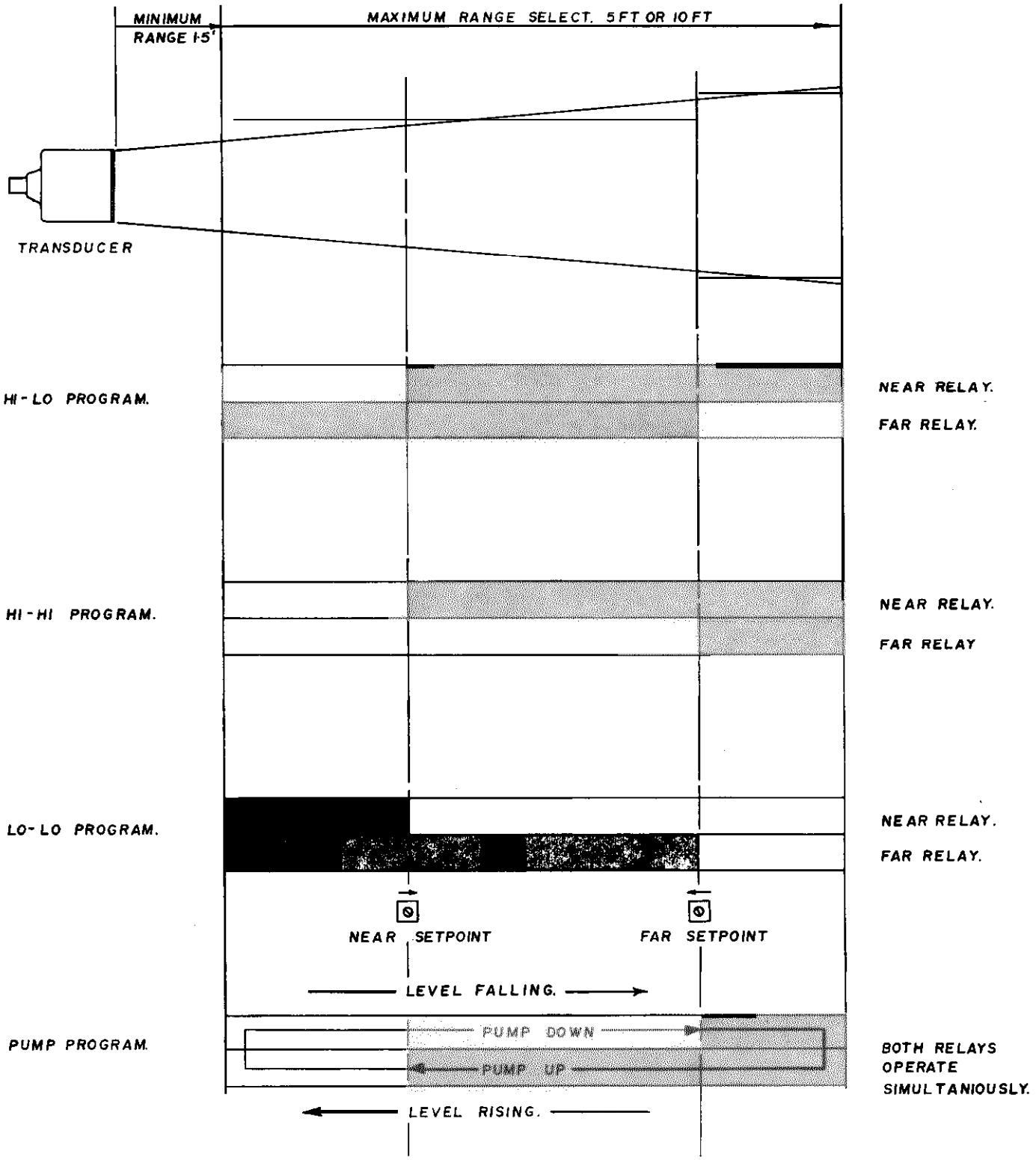


FIG. 4. OUTLINE & CABLE CONNECTION DIAGRAM.



NOTES:-

(1) ROTATION OF NEAR & FAR SETPOINT POTENTIOMETERS IN THE DIRECTION OF THE ARROW WILL MOVE THE NEAR SETPOINT TOWARDS THE MAX. RANGE & THE FAR SETPOINT TOWARDS THE TRANSDUCER RESPECTIVLY.

(2) LED INDICATORS ON, WHEN ASSOCIATED RELAYS ENERGIZED.

RELAY ENERGIZED.

RELAY DE-ENERGIZED.

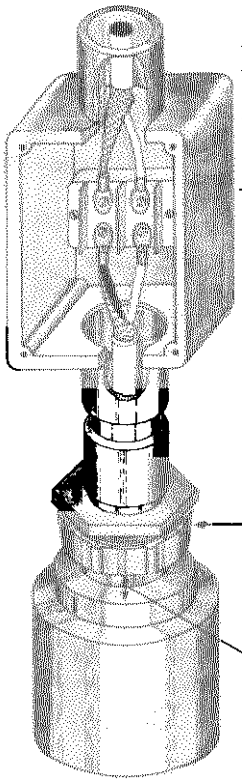
FIG-5. RELAY ACTION

10A529

1) WIRING

DO'S

- TAPE THE SHIELDS AT JUNCTION BOX TO STOP GROUND LOOPS.
- CONNECT THE TRANSDUCER SHIELD
- CONNECT THE HYDRO GROUND AT THE TRANSCEIVER.
- RUN THE TRANSDUCER CABLE IN A SEPARATE CONDUIT FROM ANY POWER WIRING.
- SYNCHRONIZE UNITS IF THEIR TRANSDUCER CABLES ARE IN THE SAME CONDUIT.



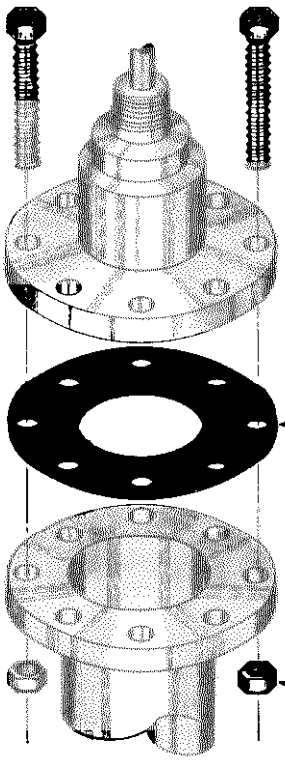
TRANSDUCER GRIP (PROVIDES MECHANICAL ISOLATION) ELIMINATES RINGING PROBLEMS, REFER TO FIG. 2.

1/8 " SPACE BETWEEN GLAND NUT OF TRANSDUCER GRIP & TRANSDUCER HOUSING

2) FLANGES

DO'S

- ENSURE THE STANDPIPE DIAMETER IS AT LEAST THAT SHOWN IN TABLE ON FIGURE 2 TRANSDUCER INSTALLATION DIAGRAM.
- ENSURE THE PVC BOLTS & GASKETING MATERIAL ARE USED WITH THE FLANGE.
- ENSURE STANDPIPE CONSTRUCTION IS WELD NECK OR SIMILAR. LAP JOINT (LJ) FLANGES ARE NOT SUITABLE.



APPROPRIATE SOFT GASKET MATERIAL

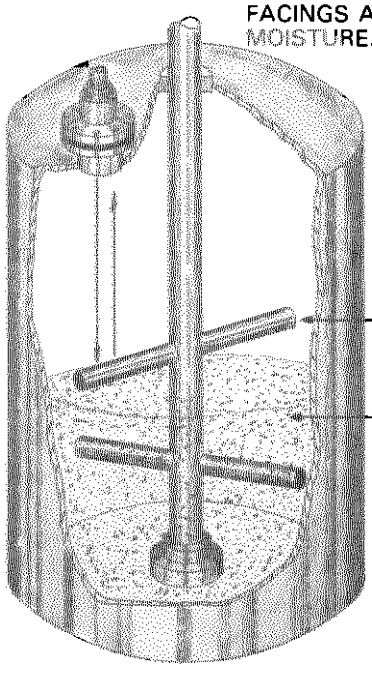
PVC BOLTS & NUTS

***DO NOT OVERTIGHTEN**

3) COMMON SENSE

DONT'S

- DON'T MOUNT TRANSDUCER OVER ANY OBSTRUCTIONS. THE TRANSDUCER MUST HAVE A CLEAR LINE OF SIGHT TO THE TARGET, ANY OBSTRUCTION WILL APPEAR AS A VALID ECHO.
- DON'T MOUNT THE TRANSDUCER CLOSE TO FILL POINTS OR DUST COLLECTOR OPENINGS, ACCOUSTICAL AIR TURBULENCE CORRESPONDS TO ELECTRICAL NOISE.
- DON'T IGNORE THE UPPER TEMPERATURE LIMIT OF THE TRANSDUCERS. (210°F, 93°C).
- DON'T MOUNT FOAM FACED TRANSDUCERS (HIGH GAIN) IN WET ENVIRONMENTS. OTHER FACINGS ARE SPECIFICALLY DESIGNED FOR MOISTURE.



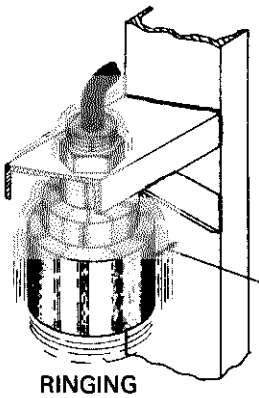
AGITATOR INTERRUPTING BEAM CAUSING IMPROPER LEVEL INDICATION

TARGET LEVEL

4) GENERAL

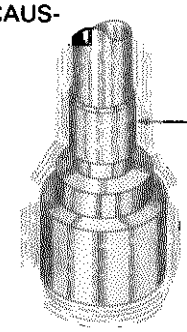
DONT'S

- DON'T MOUNT THE TRANSDUCER DIRECTLY TO METAL PLATE OR CONDUIT, UNSEEN HIGH FREQUENCY VIBRATION CAN COUPLE DIRECTLY TO THE CRYSTALS CAUSING FALSE INPUTS OR RINGING.
- MATERIALS SUCH AS WOOD, PVC, PIPE & RUBBER SHEET ARE EXCELLENT ISOLATING MATERIALS, AS IS THE CROUSE HINDS CGB3911 OR THOMAS & BETTS 2549 CABLE GRIP.



RINGING

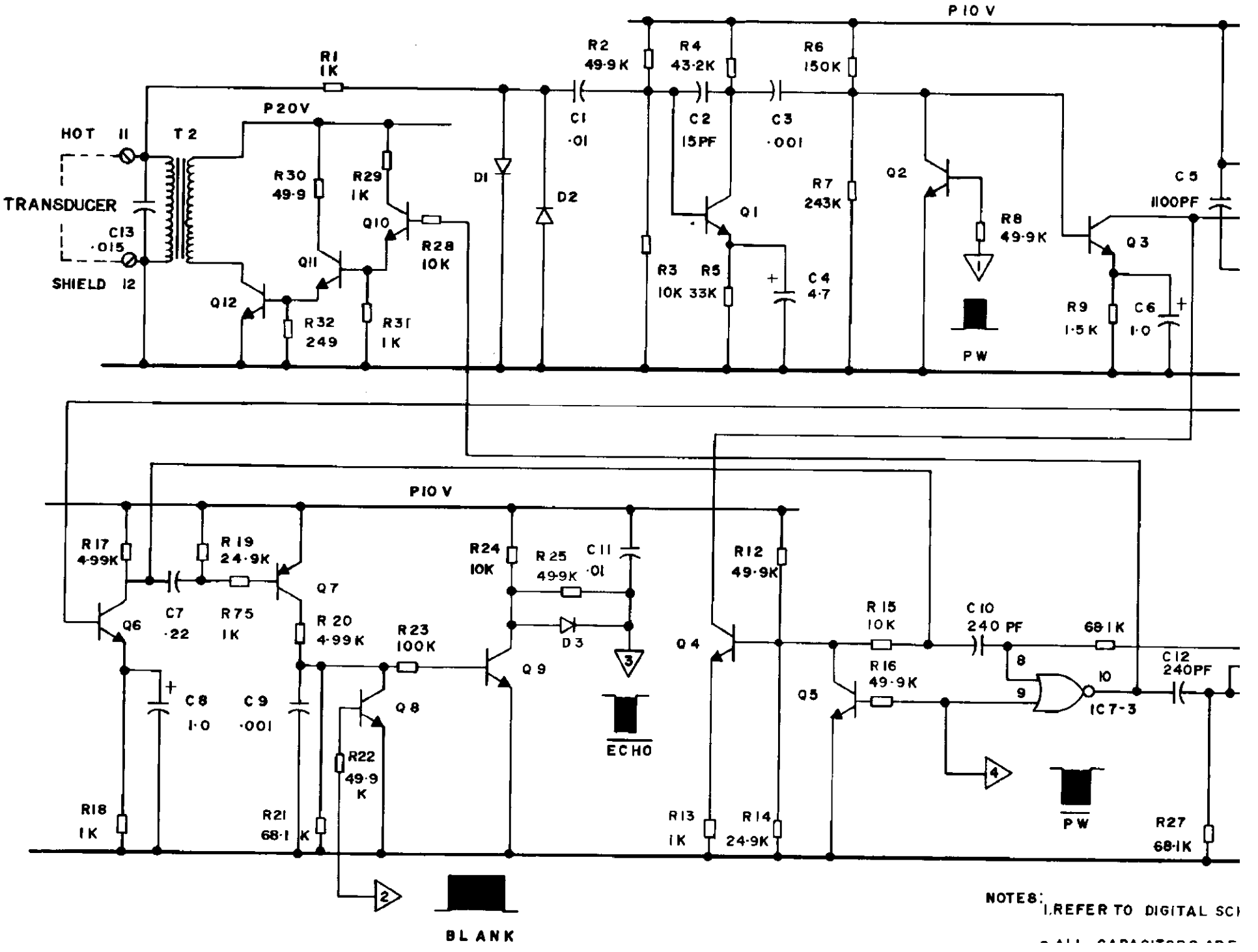
DON'T MOUNT TRANSDUCER TOO CLOSE TO VERTICAL BEAMS, TANKSIDES ETC. AS THIS WILL CAUSE ERRATIC OPERATION (BEAM RADIATES AT AN 8° ANGLE FROM TRANSDUCER FACE).



RINGING

RINGING CAUSED BY LACK OF TRANSDUCER GRIP TO COUPLE TRANSDUCER TO CONDUIT.

TRANSDUCER DO'S & DONT'S


P10V
R1 1K
R2 49·9K
R4 43·2K
R6 150K
C1 ·01
C2 15PF
C3 ·001
P20V
HOT 11
T2
TRANSDUCER
C13 ·015
SHIELD 12
R30 49·9
R29 1K
Q10
R28 10K
Q11
Q12
R32 249
R31 1K
D1
D2
Q1
R3 10K
R5 33K
C4 4·7
R7 243K
Q2
R8 49·9K
PW
Q3
R9 1·5K
C6 1·0
C5 1100PF
P10V
R17 4·99K
R19 24·9K
Q7
Q6
C7 ·22
R75 1K
R20 4·99K
R23 100K
R24 10K
R25 49·9K
C11 ·01
D3
Q9
Q8
C8 1·0
C9 ·001
R22 49·9 K
R18 1K
R21 68·1K
ECHO
BLANK
Q4
R12 49·9K
R15 10K
C10 240 PF
68·1K
R16 49·9K
Q5
IC7-3
C12 240PF
R13 1K
R14 24·9K
R27 68·1K
NOTES:
1.REFER TO DIGITAL SCI

BLANK

TRANSCEIVER SCHEMATIC.

2. ALL CAPACITORS ARE IN MF EXCEPT NOTED.

3. ALL DIODES IN 914; ALL TRANSISTORS 2N4401 EXCEPT NOTED.

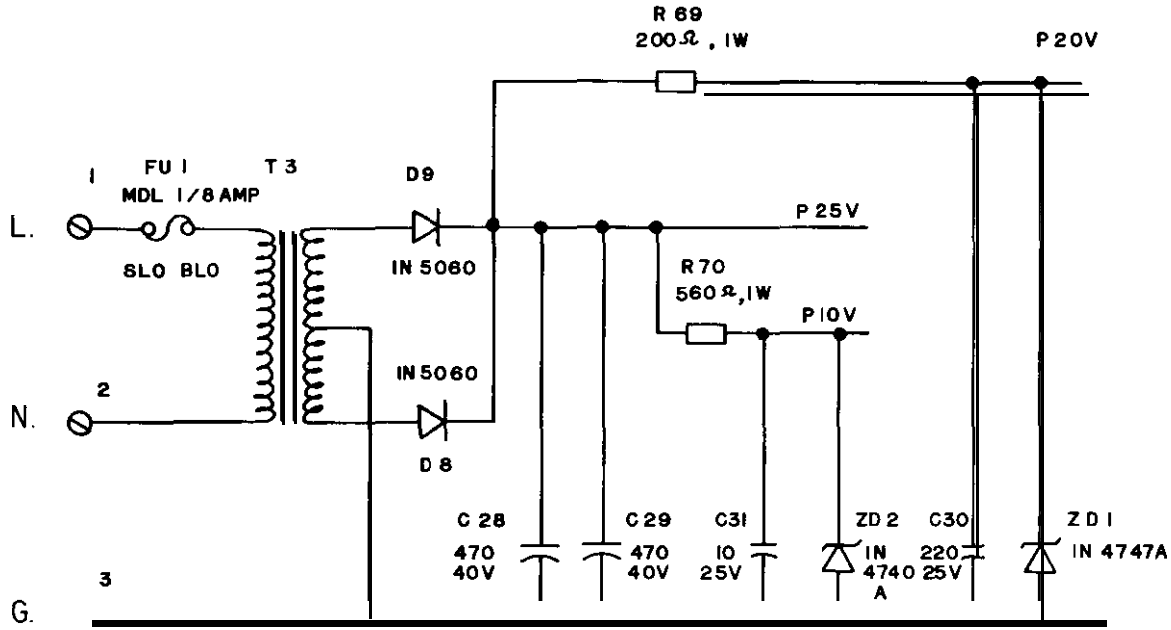


FIG. 6 TRANSCEIVER & POWER SUPPLY SCHEMATIC.

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